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Determination of Ascorbic Acid Concentration in Two Different Brands of Vitamin C Tablets Marketed in Al-khomes Libya

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Abstract: ***The amount of ascorbic acid exists in two brands (A & B) of vitamin C were measured by two different methods. The result of titrimetric analysis indicates that brands A & B have almost the same amount of the activated material which were 509.2 & 498.8mg/tablet respectively. On the same way, the results of spectrophotometric method were closed to 509.6&498.8mg/tablet. Obviously, the outcomes of these two techniques were identical,and both brands are in a good agreement with standard values.***

Keywords: ascorbic acid, vitamin C tablet, spectrophotometric, titrimetric

1. Introduction

Vitamin C (V. C) or ascorbic acid is one of the most important natural antioxidants[1-3]. Interestingly, it has been found that most plants as well as animals are able to synthesize this vitamin in their cells from glucose[2]. On the contrary, humans and some other vertebrates cannot synthesize vitamin C because they lack the enzyme L-glucono-gamma lactone oxidase which is responsible for this process. Hence, humans must get it from natural sources such as citrus fruits, and green leafy vegetables[4].
Dr. Albert S. Goyrgi was awarded Nobel Prize for his work in isolating vitamin C molecule for the first time in 1937[5]. This water-soluble vitamin is necessary for the body to form collagen in bones, cartilage, muscle, and blood vessels. In addition, V. C aids in the absorption of iron and this action useful to protect against infection by increasing white blood cell[6].Furthermore, vitamin C has the ability to promote faster healing of wounds and injuries, as well as helps the body to product adrenal hormones. Moreover, this vitamin has been associated with reduce risk of stomach, lung, oral, and prostate cancer.

Bioavailability of vitamin which describes the amount of this substance that enters the blood and lymphatic system so it is able to have an impact on the body[6], but smokers and people with a severely limited diet and individuals with health conditions that inhibit absorption of V. C may need to increase supplementation of V. C and for them supplementing V. C at the normal recommended intake is 85–90 mg per day. However, the body has to carefully control the amount of ascorbic acid circulating in a certain system throughout the day, in order to prevent any excess[7].

Statistical Analysis: Statistical analysis of two samples t-test and F-test at 95 % confidence interval were performed using r-studio package[8].

2. Materials and Methods

Two methods were used to measure the amount of ascorbic acid in vitamin C tablets: redox back titration method, and direct spectrophotometric method.

Experiments:

Collection and preparation of Samples: Vitamin C tablets were collected from local pharmacies in June 2016. Two Brands in particular were chosen for this analysis. Brand **A** and Brand **B**. Both brands were claimed to have 500 mg of ascorbic acid per tablet and all samples were checked to be within their shelve-life. Samples were prepared by selecting three tablets of each V. C sample. Tablets were weighted and crushed into a homogenized powder in a mortar.

Method 1: Redox Titration

Vitamin C was determined by using the method of redox titration with potassium iodatein the presence of potassium iodide. Ascorbic acid is a reducing agent that reduces iodine to iodide ions and oxidized to dehydroascorbic acid. Once all ascorbic acid is oxidized then the excess of iodine reacts with the starch indicator to produce dark-bluecolor indicating the endpoint of the titration.

Chemicals and Reagents:

A standard potassium iodate solution (0.01M), sodium thiosulphate solution(0.10 M), solid potassium iodide, sulphuric acid solution(0.5M), and1% starch solution used as indicator.

Procedure of the first method:

Standardization of thiosulphate:

For standardization of thiosulphate 50ml of potassium iodate solution was pipeted into an Erlenmeyer flask, then 2 g of potassium iodide were added and 10 ml of sulphuric acid solution (0.5M). Directly, the solution was titrated with thiosulfate until the color of solution nearly disappeared. Finally, the titration was resumed after 2 ml of starch indicator was added to the solution.

Analysis of vitamin C tablets:

About 0.25 g of each powdered sample was dissolved in 50ml (0.5 M) sulphuric acid and 2g of KI, 50 ml of KIO_3were added to the previous solution,after rigorous shaking the solution was titrated with thiosulphateuntilits color start to disappear. About 2 ml of starch indicator was added and the titration was completed.

Method 2: Direct Spectrophotometry

Hence ascorbic acid in solution is not stable and converts to dehydroascorbic acid[9]. The stability of ascorbic acid is pH dependant, thus a buffer is used to keep the pH at 5.4 for maximum stabilization of the acid[10, 11].The absorbance of vitamin C was measured by UV-Vis Spectrophotometer (JENWAY, MODEL-UV-6305) at wavelength 266 nm with 1cm quartzcorvette.

Chemicals and Reagents:

Buffer solution (pH = 5.4) was prepared by dissolving 4.08 g of potassium dihydrogen phosphate KH_2PO_4 and 0.16 disodium hydrogen phosphate $Na_2HPO_4.2H_2O$ in 1000 ml of distilled water.

Standard ascorbic acid solution(100ppm) was prepared by dissolving 0.025 g of ascorbic acid in 250 ml of buffer solution(pH=5.4).

Procedure of the second method:

Preparation of calibration curve Standards:

Six ascorbic acid standard solutions (0,5,10,15,20,and 25) were prepared by dilution of 100 ppm standard ascorbic acid in order to get standard calibration curve.

Analysis of vitamin C tablets:

For each powdered sample,50 mg was moved into a 50 ml volumetric flask and filled to the mark with the buffer solution. After rigorous shaking, 1ml of the prepared solution was diluted into 50 ml volumetric flask and filled to the mark with the buffer solution. In order to separate undissolved material, the diluted solution was centrifuged. Finally, absorbance of standards and samples were measured immediately at 266nm.

3. Results and Discussion

1. Average weight of the tablets:

The average weight of brand A tablets is greater than brand B which means that brand A has more excipient material as presence in table 1 below.

Table 1: Average weight in mg per tablet of the two brands of vitamin C tablets (n=6)

Brand	A	B
Weight (mg) mean ± SD	902.6±13.75	614.9 ±17.00

2. Calibration curve of standard ascorbic acid:

The linearity range of standard ascorbic acid solutions was maintained up to a concentration of 25mg/L, with a correlation coefficient R2of 0.996 as shown in figure 1.

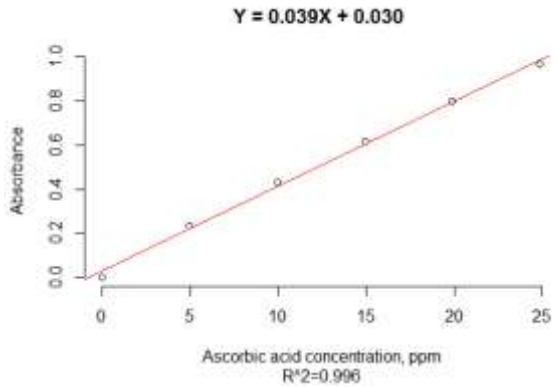

Figure 1: Calibration curve of standard ascorbic acid

3. Ascorbic acid content in vitamin C tablets:

Titrimetric as well as Spectrophotometric analysis of brand A and brand B show that the brand A contains higher ascorbic content (102%). Brand B, on the other hand, contains lower ascorbic acid content (99.8%). Statistical analysis of means and variances (t-test and F-test) of the two analytical methods prove that results obtained by the two methods was approximately similar.

Table 2: Ascorbic acid content (mg per tablet) in brands of vitamin C tablets(n=6)

Method	A	B
Titrimetric	509.2±7.03	498.8±2.97
Spectrophotometric	509.6 ±4.61	498.8±2.28

4. Conclusion

To sum up, results show that both tested Brands contain ascorbic acid values very similar to the claimed values by the manufactures. Additionally, the two analytical methods are suitable for analyzing vitamin C tablets without any interference.

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